PROJECT FACT SHEET

CONTRACT TITLE: Application of Reservoir Characterization and Advanced Technology Improves Recovery and Economics in Lower Quality Shallow Shelf San Andres Reservoirs -- Class II

ID NUMBER: DE-FC22-93BC14990

B&R CODE: AC1010000

CONTRACTOR: Oxy USA Inc.

ADDR: P.O. Box 50250
Midland, TX 79710

DOE PROJECT MANAGER:

NAME: Gary D. Walker
LOCATION: NPTO
PHONE: 918/ 699-2083
E-MAIL: gary.walker@npto.doe.gov

CONTRACT PROJECT MANAGER:

NAME: Tom Beebe
PHONE: 281/ 552-1038
FAX: 281/ 552-1283
E-MAIL: tom_beebe@oxy.com

PROJECT SITE
CITY: Midland **STATE:** TX
CITY: West Welch Field, Dawson County **STATE:** TX
CITY: **STATE:**

CONTRACT PERFORMANCE PERIOD:
8/3/1994 to 9/3/2002

PROGRAM: Reservoir Life Extension
RESEARCH AREA: Seismic/Class 2
PRODUCT LINE: ADIS

CO-PARTICIPANTS:

PERFORMER: Geostrat Assoc	**CITY:** Midland	**STATE:** TX	**CD:** 21
PERFORMER: UTFB/CEED	**CITY:** Odessa	**STATE:** TX	**CD:** 19
PERFORMER: Hickman & Assoc	**CITY:** Midland	**STATE:** TX	**CD:** 21
PERFORMER: Halliburton Services	**CITY:** Midland	**STATE:** TX	**CD:** 21

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	11108	11108	22216
FY 2002 CURRENT OBLIGATIONS	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	11108	11108	22216

OBJECTIVE: This field project will demonstrate the application of cross wellbore tomography, hydraulic fracture orientation detection, 3-D seismic methods, and cyclic CO2 stimulation to improve the economics of conventional CO2 flooding.

March 2002

PROJECT DESCRIPTION:

Background: In 1991 OXY USA had identified recoverable reserves of 42 MMSTBO from current EOR technology. The project has drilled 5 new wells producing at 100 BOPD. Two new field demonstration wells were completed based on 3-D seismic-guided mapping. Production from these wells has reached 200 BOPD with estimates of 300,000 bbls additional reserves. After proceeding with the CO2 flood at South Welch Unit, which began CO2 injection in 1993, lower oil prices were forecasted. With the lower prices, the estimated recoverable EOR reserves dropped to 17 MMSTBO. OXY USA began evaluation of cyclic CO2 treatments to accelerate production and recover additional oil that would not be recovered by conventional CO2 flooding. Seismic tomography will be incorporated into the reservoir description process. This approach is expected to assist with projects that have marginal economics at current prices.

Work to be Performed: Verify field test hypothesis of improved economics for recovering oil through miscible CO2 flooding of low permeability reservoirs against a conventional CO2 flood, using new technology combining tomography, 3-D seismic, logging, and core data. Evaluate economics of enhancement techniques to include cyclic CO2, fracturing injection wells, and mobility control.

PROJECT STATUS:

Current Work: Project is in Budget Period II.

Scheduled Milestones:

Drill Expansion Area Well	12/98
Project Operation	12/01
Tomography data interpreted CO2 migration path	07/00
Horizontal well drilled to replace fracture objectives	12/00
Project extension for the purpose of evaluating response that has been slow to occur	mid/01
Final report	12/02

Accomplishments: 3D seismic integration improved the history match over the base geologic model results. Reservoir fracture analysis completed. Economics for the project were completed and recommendation to proceed to budget period 2 was made and approved. Software changes improved the depth ties of the cross well seismic lines. The 7 lines completed show reservoir structures, between wells, to 10 foot vertical resolution. The 3-D Seismic integration has been used to map reserves with an estimated 300,000 bbls of additional reserves for the West Welch Unit. Evaluation of seismic responses led to the development of a statistical relationship between pore volume and seismic attributes. The five new wells showed the seismic guided mapping was accurate for porosity mapping and initially produce 100 BOPD.

CO2 is currently being injected into 6 injection wells with each well the center of a 7-spot 40 acre pattern. Project focus in 2000 has been to increase the processing rate of the reservoir to improve project economics. Dip-ins (pressure bombs ran in the injection well measuring CO2 bottom hole injecting pressure) were ran to determine the appropriate CO2 surface pressure for optimal CO2 injection. Since running the Dip-ins we have increased the CO2 injection rate approximately 20% which is a significant improvement. As noted above, a horizontal well was planned and drilled in 12/00 for the purpose of capturing poorly swept oil reserves from the 7-spot pattern and accelerate the reservoir processing rate. The lateral length was 3500' and designed to fracture stimulate 6 locations throughout the lateral using a new Halliburton technology – SURGI fracturing tool. Mechanical problems with the tool, stimulation pumping design problems and reservoir conditions limited the effectiveness of the stimulation. Even with stimulation issues the well did produce an incremental 30 BOPD, but with high gas production resulting in the well to be shut-in due to gas plant limitations.

Work continues at addressing the reservoir processing rate and minimal tertiary response observed in offset producing wells. Several well stimulations have been performed or are in progress to remove skin to help initiate tertiary response. Ten well workovers have been done or are in progress to enhance wellbore conditions. Positive results have been realized, but not in all wells. A more impressive reult has been realized in WWU #4818 a producing well that produced 6 BOPD and 10 BWPD prior to being worked over. After the workover, #4818 is tecting at 63 BOPD and 31 BWPD. Efforts to improve performance in other wells recently stimulated have been through lift revisions and optimization of the pump off controllers. From the injection profile work done in the first half of the year one injection well was identified as having poor conformance and low injection rate. This well, #4805 has a well stimulation procedure scheduled to address vertical conformance and improve the injection rate.

An induction log was run on observation well WWU #4852 for the purpose of tracking CO2 migration in the reservoir. The evaluation of the log gave inconclusive results. The issue was at high OHMS the induction log measures resistivity poorly. Previous induction log (1997 logging run) compared to this induction log run did not compare well at high OHMS which made differences between measurements difficult to conclude if the change is due to CO2 in the reservoir. A lateral log and neutron log are to be run that can be compared to a previous lateral log to calculate if a CO2 movement within the reseroir can be detected.

TECHNOLOGY TRANSFER:

Technology/Information Transfer:

Public Relations:

Updated By: **Dan Ferguson** Date: **12/11/2001**